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Recurrent Expenditure Requirements of Capital Projects

Estimation for Budget Purposes

Ron Hood
David Husband
Fei Yu

The World Bank
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Abstract

This paper examines the issue of estimating recurrent costs associated with capital projects in the investment budget. It is intended to help overcome budget planning problems which give rise to the chronic underfunding of maintenance and operating costs typical in some developing economies. The objective is to provide guidance in the preparation of budget submissions so that information on the future recurrent cost implications of today's capital spending is quantified in a way that supports the authorities in making project selection and budget decisions.

The paper is in three parts. The first part outlines some concepts and definitions involved in measuring recurrent costs. The second part provides stylized examples of individual projects. And the third part presents some rough empirical guidance drawn from a sample of actual investment projects.

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Ronald Hood
Senior Country Economist, ECSPE, The World Bank
rhood@worldbank.org

David Husband
Global Economics Ltd
david_husband@hotmail.com

Fei Yu,
Kennedy School of Government, Harvard University,
Fei_Yu@Ksgphd.Harvard.Edu

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Introduction

Recurrent expenditures needed to operate and maintain public investment projects should be estimated so as to facilitate their provision in National Budget and Ministry allocations. Such estimates will help ensure a connection between the capital and recurrent components of the budget, leading to sounder macroeconomic management. Further, estimates of recurrent expenditures will contribute to overall evaluation of investment alternatives, thereby improving project selection during the formulation of public investment programs. Estimates of these costs should therefore be presented as along with investment budget spending proposals.

The importance of estimating recurrent expenditures is underscored by the shift in many developing countries to greater emphasis on the social sectors. Public investments in these sectors give rise to high recurrent expenditures – much more so, on a relative basis, than for public investments in transportation, telecommunications, energy and water supply infrastructure.

Estimating Recurrent Costs

Defining Recurrent Expenditures

Recurrent expenditures associated with a public investment project are those operations and maintenance expenditures needed to run the project at a level consistent with its expected use, and to maintain the capacity of the investment during its expected lifetime. For example recurrent expenditures in the case of a new school serving an expanded student population would include the teachers' salaries and additional textbooks and teaching materials required to operate the new facility. They would also include electricity, heating and other costs needed to operate the facility, and the regular and periodic maintenance needed to maintain the facility. Importantly, recurrent expenditures should reflect full capacity utilization of the facility – that is, the recurrent expenditures expected when the investment is being used as designed.

Recurrent expenditures will be both direct and indirect. Clearly, increasing the number of teachers to staff additional classrooms is a direct cost of investment in improved access to education. Teacher training to supply the necessary teachers may be an indirect cost – unless explicitly provided for as part of the investment project. If possible, indirect recurrent expenditures should be referenced in public investment proposals.

The composition of recurrent expenditures will vary considerably among sectors. For transportation, the main factor is maintenance, whereas for the health and education sectors the main factor is operations. For irrigation projects, both operations and maintenance expenditures are important. With regard to maintenance, sufficient provision should be made to ensure that the facility does not deteriorate beyond normal depreciation. Inadequate road maintenance, for example, results in early reconstruction costs – at great additional expense. On the other hand, maintenance should not be confused with upgrading of capital facilities.

Maintenance of capital also applies to investment in human capital. Training of Ministry staff and other forms of investment in human capital, notably teacher training, should be followed-up after the initial investment by regular and periodic refresher courses.

Incremental recurrent expenditures for are recurrent costs associated with new projects that are above and beyond ongoing recurrent expenditures already built into the budgetary process to cover the existing 'stock' of public investment.

Private Versus Public Costs

Recurrent costs may be borne by both private users of project facilities and government agencies responsible for the operation and maintenance of the facilities. Since the concern here is with better public sector management, only recurrent expenditures that bear upon the budget are considered.[1]

Excluded, therefore, would be privately borne vehicle operating costs of using a new road. However, care must be exercised against assuming too much of the private sector. In some countries, parents are expected to bear a heavy share of the cost of their children's education, or of providing health care services for their families, undermining universal access. The ratio between capital cost and recurrent expenditures borne by the Government should be consistent with the goals of the Government.

Public investment projects involving state-owned enterprises require some consultation with the Ministry of Finance. While such projects are normally "off budget", they may give rise to contingent liabilities for the Government (e.g., the pension and severance rights of employees of a privatized SOE). These costs may be lump sum or spread over several years. Note should be made of such costs.

Project Implementation Costs Versus Post-Implementation Recurrent Expenditures

As in the case of the World Bank, public investment proposals may refer to recurrent expenditures during project implementation. However, these expenditures should be counted as part of the capital costs of the project.

Project implementation costs include civil works, goods/equipment procurement and services. Extensive land acquisition costs may also be involved, as in the case of hydropower projects. Public investment projects normally include provision to cover the fees of consultants, engineers, project managers and the like that recur each year until the project is fully implemented. Miscellaneous expenses during implementation may include salaries of additional staff needed to implement the project, the cost of hiring vehicles, office expenses etc.

These project implementation costs should be aggregated and classified as a one-time expense, even if spread over several years until project implementation is complete. They should not be confused with true recurrent expenditures associated with operation and maintenance.

[1] Cost-benefit analysis should, of course, consider both private and public costs.

Timeframe for Recurrent Expenditures

Project implementation is typically phased, so components of the project become operational before the full project is complete. In this case, recurrent expenditures related to operation and maintenance will also commence before project implementation is completed.

Project documentation should indicate when true recurrent expenditures are expected to begin, their initial levels, and their build-up to the point of full operation. Project documentation should also indicate the life of the investment and the pattern of recurrent expenditures consistent with this timeframe.

Average annual recurrent costs can be used to indicate medium to long-term recurrent costs. This will help simplify provision for periodic maintenance costs, as arise for transportation and other forms of capital investment.

In some cases provision may be necessary for phased escalation of recurrent costs. For example, scheduled increases in teachers' salaries should be reflected in the salaries of teachers hired so as to add new capacity to the school system.

The estimation of recurrent expenditures should derive from country-based data concerning operating and maintenance costs. However, caution is in order so as to avoid repeating under-provision for recurrent expenditures. Such under-provision is been systemic and serious in many developing countries.

Incremental and Indirect Costs

The cost estimates should be *incremental* recurrent costs. That is, they should include only those additional costs that must be made because of the project and would not have been necessary if the project had not been undertaken. Some of these incremental recurrent costs may be indirect. For instance if a project establishes a number of new schools in a province it may be necessary to increase the number of staff for provincial administration. Although these additional staff are not working in the new schools their salaries should be counted as an indirect recurrent cost.

The following two examples are meant to demonstrate the types of costs that should be included in recurrent costs estimates as well as the relationship between implementation and operating periods.

Example 1: An Irrigation Project

The first example is an irrigation project which has four phases. In each of four successive years, pumps are installed and ditches dug to create new irrigated areas. As a result the project lasts four years but the operating period begins in the second year when the first pumps begin pumping. The main operating cost is fuel for the pumps. This cost begins in year two and jumps up again in years three, four and five as each of the new pumps comes on stream. Thereafter the costs increase in line with the expected rise in the price of fuel. Costs for spares for the pumps are relatively small and are shown in the next line. Maintenance has to components. The first is routine maintenance which consists of dredging the ditches to ensure adequate flow. In addition, once every two years the pumps are taken apart and overhauled to ensure their continued operation. Fees collected from the participating farmers are used to pay for a portion of the fuel and this partially offsets the amount that has to be covered from the budget.

Irrigation Project

	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
Implementation period											
Operating period											
Gross Recurrent Costs											
Operating Costs		6.0	12 0	18.0	24.2	25.6	27.2	28.8	30.5	32.4	34.3
fuel		5.0	10.0	15.0	21.0	22 3	23.6	25.0	26.5	28 1	29.8
spares		1.0	2.0	3.0	3.2	3.4	3.6	3.8	4.0	4.3	4.5
Maintenance			2 0	7.0	3.0	7 0	3.0	7.0	3.0	8.0	3.0
routine			2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
periodic				4.0		4.0		4.0		5.0	
Total		6.0	14.0	25.0	27.2	32.6	30.2	35.8	33 5	40 4	37.3
Recurrent Cost recovery											
fees from farmers		1.0	2.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Net Budgetary Requirement		5.0	12.0	22.0	23.2	28.6	26.2	31.8	29.5	36.4	33.3

Example 2: A School Project

The second example is a project to build a secondary school. The school is built in FY01 and opens in FY02. So the implementation period is FY01 and the operation period is from FY02 on. However the project actually lasts two years because it includes a component for training for teachers during the first year of operation. Ongoing training will be required every year to maintain the teacher's skills and this is reflected in the stream of recurrent costs under teacher training. However, since training in the first year is included as part of the project budget, the project provides one year of cost recovery for this recurrent cost as shown under FY02.[2] For subsequent years the training has be paid for out of the annual recurrent budget. Fees collected from students provide a further offset to the recurrent budget. The amount of recurrent costs that that will have to be funded out of the budget is given in the last line – Net Budgetary Requirement

[2] In effect the 1.0 for training in FY02 is already accounted for in the capital budget (PIP) since it is part of the project.

Secondary School Project

	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09
Implementation period									
Operating period									
Gross Recurrent Costs									
Operating Costs		117.0	122.8	128.9	135.4	142.2	149.3	156.7	164.6
teacher salaries		100.0	105.0	110.3	115.8	121.6	127.6	134.0	140.7
teacher training		1.0	1.0	1.1	1.1	1.2	1.2	1.3	1.3
materials and supplies		10.0	10.5	11.0	11.6	12.2	12.8	13.4	14.1
utilities		1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.4
indirect costs									
new central admin staff wages		5.0	5.3	5.5	5.8	6.1	6.4	6.7	7.0
Maintenance		2.0	2.1	2.2	2.3	2.4	2.6	2.7	2.8
Total Recurrent Costs		119.0	125.0	131.2	137.8	144.6	151.9	159.5	167.4
Recurrent Cost recovery									
recurrent costs covered by project		1.0							
fees from students		4.0	4.2	4.4	4.6	4.9	5.1	5.4	5.6
Net budgetary Requirement		114.0	120.8	126.8	133.1	139.8	146.8	154.1	161.8

R-Coefficients

As a guide to estimating the desired level of recurrent expenditure with any given public investment proposal ratios of recurrent expenditure to investment expenditure have been calculated for 10 categories (and some 75 subcategories) of investment.[3] The ratios are based in World Bank and ADB projects in many countries. Because the ratios reflect averages over a variety of country situations, they should be viewed as no more than indicative of actual requirements in any given country.

Comparison of ADB and WB Projects: Summary of 'r' coefficients, by Sector:

	ADB Projects			World Bank Projects		
Sector	Number of projects	Average r-coefficient	Median r-coefficient	Number of projects	Average r-coefficient	Median r-coefficient
Agriculture	7	0.023	0.010	22	0 047	0 019
Education	3	0.029	0.011	17	0.074	0 032
Energy	7	0.047	0.037	14	0.013	0.002
Environment	5	0.074	0.056	12	0.017	0.014
Health	5	0.073	0.020	15	0.030	0.029
Telecommunications	4	0.043	0.027	3	0.003	0.000
Transportation	6	0.019	0.010	15	0.025	0.009
Urban Development	2	0.016	0.016	11	0.017	0.013
Water supply/sanitation	5	0.054	0.063	12	0.044	0.021
Average all sectors (unweighted)	44	0.042	0.028	123	0.030	0.014
Average all sectors (weighted)	44	0.043	0.028	123	0.035	0.017

[3] This follows a method similar to that described in Heller, Peter; "Underfinancing of Recurrent Development Costs", Finance and Development, 16:1:38-41 March 1979, World Bank and IMF.

The r coefficients shown above indicate annual incremental recurrent expenditures expressed as a proportion of total project investment costs. The average for all sectors is indicated as 0.035. This suggests that for every $1 million of project investment included in the PIP, some $35,000 per year is needed to meet incremental recurrent expenditures. Officials need to judge whether or not this ratio approximates what is needed in their own country.

Distinguishing Between Quality and Quantity

There is a substantial range in r coefficients across projects even within a sector. This highlights the need to distinguish between projects that add to capacity versus those that lead to quality improvements in existing facilities or services. Reference to primary education is again illustrative. Investment in rehabilitation or construction of a new school to upgrade an existing primary school facility may give rise to only small additional operational costs, as the costs of teachers' salaries and teaching materials are already provided for. Also, investment in quality improvements is normally accompanied by teacher training and other upgrades. These tend to have very beneficial effects in reducing repetition rates, especially at the primary level, and may even lead to savings in recurrent costs. Public investment project proposals should factor in efficiency gains as possible offsets to future recurrent costs.

Investment in a new school designed either to accommodate an increase in the student population or to extend education services to remote areas, give rise to much higher recurrent expenditures. Most importantly, of course, are the costs of salaries for the additional teachers needed for the additional classrooms. Other costs include teaching materials, lighting costs, maintenance etc.

This distinction between quantity versus quality improvements applies across a broad range of public investment projects. In addition to education, Appendix A notes this distinction for irrigation, health, water supply and sanitation, and transportation projects. The tables with more detailed project classification given in the appendix show that the "r" coefficients for expansion of the capacity of the systems is generally much higher than for quality improvements. It will also be noted that the "r" coefficients for the education and health sectors are much higher that for other sectors – reflecting the importance of annual salary costs.

Blended Projects

Many projects, of course, will blend quantity and quality improvements. Furthermore, they may include several very different project components, such as institutional capacity building, each with its own "r" coefficient. In these cases, officials will need to disassemble the project into its respective parts and apply the relevant "r" coefficients, summing to get incremental annual recurrent expenditures. Alternatively, officials may apply a blended "r" coefficient.

Gross Versus Net Recurrent Expenditures

To more accurately reflect potential contingent liabilities for the Government from public investment proposals, recurrent expenditures should first be estimated in terms of gross or overall annual operating and maintenance costs. If there are user charges or other mechanisms through which the private sector bearing a portion of the costs, then these should be shown as offsets – as indicated in the introduction.

Very often, public investment proposals incorporating user charges are based on overly optimistic expectations regarding such revenues. The record of many developing countries concerning pricing of public services (e.g., water, irrigation and electricity rates) is poor. Further, collection

of user charges is often extremely weak. The cumulative effect is that recurrent expenditures met by the Government more closely approximate gross rather than net requirements.

Nonetheless, where relevant, public investment proposals should include plans for revenue offsets to recurrent expenditures. These plans should be credible, having received the approval of the Government Committee responsible for preparing and vetting the PIP.

Public investment proposals should also indicate donor assistance that has been committed in support for operating and maintenance expenditures. Lao P.D.R.'s newly established Road Maintenance Fund, by way of example, includes considerable donor support for road maintenance over the next five years.

Appendix A: R-Coefficient Calculations

R-coefficients were calculated for a set of World Bank and ADB projects by taking the following steps:

- classifying projects into types appropriate for estimating recurrent costs;
- identifying recurrent costs in each case;
- calculating recurrent costs as a ratio of capital costs for each type of project.

World Bank Projects

Using the World Bank Data Bank, Project Appraisal Documents (PADs), were scanned to identify those that appeared to include enough information about recurrent costs to enable estimation of the r coefficient. Some 123 PADs were drawn upon.

The classification of projects by sector generally followed that of the WB site. The level of detail and quality of data varies significantly across the PADs, despite the overall similarity of document and annex structure. Different sectors tend to have different analytical characteristics, which have implications for the ease of identification of incremental recurrent costs attributable to investments made under the projects.

The PADs normally identify 'incremental operating costs' during project implementation (as these are sometimes covered by a WB loan). The scale and type of these costs during the project implementation period are rarely similar to the incremental recurrent expenditure implications for governments thereafter.

Sometimes relevant material about incremental cost issues is contained in the economic analysis even if it is not summarised in the financial analysis tables. Calculating r coefficients therefore typically involves the process of scanning all sections of the PAD.

Annual Recurrent Expenditures as a Proportion of Public Investment Projects: Indicative "r" Coefficients

	Sector	"r" coefficient
Agriculture		
1	Agricultural Research and Extension Services	0.035-0.054
2	Agro-industry and Marketing	0.008-0.380
3	Fisheries and Aqua-culture	0.206
4	Forestry	0.010-0.036
5	Irrigation & Drainage	
6	*Expansion of capacity*	0.011-0.033
7	*Rehabilitation*	0.017-0.046
8	General Agriculture	0.003-0.042
9	Soil Conservation and Watershed Development	0.042
10	Agriculture Institutions Capacity Building	0.014
Education		
11	Access re Quantity: Expansion or New Facilities Resulting in More Capacity	0.071-0.137
12	*Primary Education*	0.019-0.331
13	*Secondary Education*	
14	*Tertiary Education*	
15	Access re Quality: Rehabilitation or Replacement of Existing Facilities	0.030-0.331
16	*Primary Education*	0.030-0.071
17	*Secondary Education*	0.030
18	*Tertiary Education*	0.044
19	Quality of Education	
20	*Teacher Training*	0.008-0.012
21	*Curriculum and Education Materials/Equipment*	0.040-0.080
22	Vocational Education and Training	0.032-0 249
23	Education Institutions Capacity Building	0.003-0.094
Energy		
24	Generation	0.001-0.028
25	*Hydroelectric Power*	0.008-0.050
26	*Renewable Energy*	0.000-0.101
27	*Thermoelectric Power*	0.012-0.101
28	Transmission	0.001-0.008
29	Distribution	0.001-0.003
30	*Rural electrification*	0.020
31	*Urban Services*	
32	Energy Institutions Capacity Building	0.001-0.003
Environment		
33	Biodiversity Conservation	0.008-0.019
34	Land Conservation	0.030
35	Water Resources Management and Conservation	0.000-0.046
36	Industrial Pollution Control	0.016
37	Wastewater Treatment	
38	*Upgrading*	0.010
39	*New Facilities*	
40	Environmental Institutions Capacity Building	

Health & Population	
41 Primary Health Care	0.002-0.044
42 *Upgrading Health Centers*	0.004-0.069
43 *Expanding Health Center Services*	0.042-0.060
44 *Public Health Programs*	0.018-0.050
45 Curative Health Care	
46 *Upgrading of provincial and national hospitals*	
47 *Provision of new hospitals*	
48 *Medical equipment projects*	0.055
49 Health Institutions Capacity Building	0.002-0.055
Mining	
50 Upgrading of Mining Facilities	0.040
51 New Facilities/Institutional Strengthening	0.017
Telecommunications & Informatics	
52 Modernization of Existing Systems	
53 Investment in New Systems	
54 Information Technology Services	0.000
55 Telecommunications Institutions Capacity Building	0.000-0.009
Transportation	
56 Upgrading of Existing Road Facilities	0.000-0.050
57 *Highways*	0.000-0.053
58 *Secondary Roads*	0.009
59 *Urban Roads*	0.002-0.006
60 *Rural Roads*	
61 *Feeder Roads*	
62 Investment in New Roads	
63 *Highways*	
64 *Secondary Roads*	
65 *Urban Roads*	0.022
66 *Rural Roads*	
67 *Feeder Roads*	0.345
68 Road Maintenance Fund	0.050-0.100
69 Upgrading of Existing Water Transportation Facilities	0.050
70 Investment in New Water Transportation Facilities	
71 Upgrading of Existing Rail Transportation Facilities	0.033
72 Investment in New Rail Transportation Facilities	
73 Upgrading of Existing Air Transportation Facilities	
74 Investment in New Air Transportation Facilities	0.050
75 Transportation Institutions Capacity Building	0.050
Urban Development	
76 Municipal Development	0.000-0.037
77 Solid Waste Disposal/Treatment	0.050
78 *Upgrading*	0.004-0.008
79 *New Facilities*	
Water Supply & Sanitation	
80 Rural Water Supply & Sanitation	
81 *Upgrading*	0.007-0.024
82 *New Facilities*	0.087
83 Urban Water Supply & Sanitation	0.020-0.053
84 *Upgrading*	0.000-0.053
85 *New Facilities*	0.027-0.262
86 Sewerage Collection and Treatment	0.022-0.027
87 Institutional Capacity Building	0.021

ADB Projects

Data on recurrent expenditures were obtained from two types of ADB published documents: (i) Report and Recommendations of the President to ADB Board of Directors (RRPs) that contained project cost estimates, and, in some cases, details of economic and financial analyses; and (ii) Project Performance Audit Reports (PPARs) that contained actual project costs, and, in some cases, detailed post-evaluation economic and financial analyses. The source documents were downloaded from ADB's website. However, in the case of PPARs, hardcopies of the documents were requested from ADB's Secretary's Office since the appendices that contained the required information had been omitted in the web version. Over 70 project documents in the form of ADOBE Acrobat PDF files were downloaded, of which 44 projects (of the 70 downloaded) were included in the computation of the R-coefficients as only these projects contained the needed information.

Details of the Calculation of the R-coefficients

The R-coefficients were estimated using one of the following methodologies, the choice of which was made based on the availability of the required information:

(i) Ratio of the average annual incremental operating and maintenance expenditures contained in either the financial or economic IRR computations to the total project cost amount (*the total project cost differed slightly from the total investment cost since the latter included interest expense during construction and contingencies*);

(ii) Ratio of the calculated average incremental recurrent expenditures that was part of the project cost estimate to the total investment cost; and

(iii) Ratio of the observed/assumed annual incremental recurrent expenditures to either total project cost or total investment cost.

In addition to the arithmetic average of R-coefficients that was computed for each sector, the median was also obtained as an alternative measure of central location. The median was computed for both ADB- and World Bank-assisted projects.

Comparison of ADB and WB Projects: Summary of 'r' coefficients, by Sector:

	ADB Projects			World Bank Projects		
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Agriculture	7	0.023	0.010	22	0.047	0.019
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Average all sectors (unweighted)	44	0.042	0.028	123	0.030	0.014
Average all sectors (weighted)	44	0 043	0 028	123	0.035	0.017

For most of the sectors in both the ADB and World Bank calculated R-coefficients, the median was found to be lower than the arithmetic average, indicating that the distributions of R-coefficients were positively skewed. This implies that for most of the sectors, a significant number of R-coefficients were lower than the sectoral arithmetic average. A cursory look at the tables confirmed this finding. Further, this implies that the values of the sectoral arithmetic averages were influenced by a few "outlying" high R-coefficients.

A statistical test of hypothesis was performed to determine whether or not there is a significant difference in the average R-coefficients of ADB- and World Bank-assisted projects. The test showed that there is no significant difference between the two averages based on the data given in the above table.

t-Test: Two-Sample Assuming Unequal Variances

	ADB	*World Bank*
Mean	0.041984795	0.029955493
Variance	0.000477514	0.000479818
Observations	9	9
Hypothesized Mean Difference	0	
df	16	
t Stat	1.166354174	
P(T<=t) one-tail	0.130281398	
t Critical one-tail	1.745884219	
P(T<=t) two-tail	0.260562796	
t Critical two-tail	2.119904821	

Conclusion: There is no significant difference between the average "r" ratio for ADB- and World Bank-financed projects.

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